J. Hortl. Sci.
Vol. 9(1):23-26, 2014

Influence of pruning intensity on yield and quality of nectarine peach

Nidhika Thakur and Vishal S. Rana
Department of Fruit Science, College of Horticulture
Dr. Y.S. Parmar University of Horticulture and Forestry
Nauni, Solan - 173 230, India
E-mail: drvishal_uhf@rediffmail.com

ABSTRACT

A study was conducted to improve fruit yield and quality in nectarine through pruning. Six-year old plants of two cultivars, Silver King and Snow Queen, were given nine different pruning treatments, with three replications, in Complete Randomized Block Design. Results showed that on increasing pruning intensity, fruit yield decreased, while quality of the fruits improved. Best quality fruits in terms of fruit weight and pulp:stone ratio were obtained with 60% thinning-out + ¾ heading-back, while, maximum fruit surface colour and total soluble solids (TSS) were recorded with 40% thinning-out + ¾ heading-back. Highest acidity in fruits was recorded with 20% thinning-out + ¼ heading-back. Among the two cultivars, 'Silver King' exhibited better fruit quality than 'Snow Queen'.

Key words: Nectarine, pruning, thinning-out, heading-back, yield, quality

INTRODUCTION

The peach [*Prunus persica* (L.) Batsch.] is one of the important stone fruits with a wide range of climatic adaptations. It is globally distributed between 30° to 40° latitudes where strong light, clear skies, a long season and warm temperatures prevail (Rom, 1988). Peach is the third most important temperate fruit cultivated in India. The peach, including nectarine, commands considerable importance in the economy of Himachal Pradesh, the leading peach producing state of India, producing 11,276 MT of peach from 5,159 hectares with productivity of 2.19 tons /hectare (Anon., 2013).

Nectarines (*Prunus persica* var. *nucipersica)* are smooth-skinned fruits closely allied to peach, and are non-pubescent. They have originated apparently from peach by mutation. Outer appearance of the fruit resembles a plum, but within it is like peach. Lack of pubescence is controlled by a single, recessive gene. Fruits are more aromatic than the peach and have a distinct winy flavour. Two important cultivars, namely, 'Silver King' and 'Snow Queen', have shown promise in recent years for cultivation in mid-hills of Himachal Pradesh. 'Snow Queen' is a sweet and juicy nectarine, suitable for mild-winter climates. The trees produce abundant harvest of delicious, white nectarines.

Pruning is an important horticultural operation for obtaining higher yields of superior quality fruits. It prevents excessive fruiting, increases fruit size and facilitates light penetration into the interior of the tree canopy, which improves fruit coloration (Mika, 1986). Performance of peach/nectarine trees depends heavily on proper, annual pruning. In terms of pruning, both peach and nectarine can be treated similarly as their flowering and fruiting habits are the same. Nectarine fruits are borne on one-year old wood which turns barren later, and no flower-bud differentiation or subsequent fruit-formation occurs in this part of the branch (Badiyala and Awasthi, 1989). Stone-fruit plants in general, and peaches in particular, are pruned in two ways, i.e., heading-back and thinning-out. When just one-third to one-half terminal portions of the branches with their basal portion intact are removed, it is termed 'heading-back'. Apical dominance of the twig is destroyed and lateral buds are stimulated to grow. When the branches are considered undesirable, these are removed entirely from the point of attachment without leaving any stub, and this is termed 'thinning-out' (Kaur, 2010). When the trees are not pruned annually, the volume of fruiting wood is reduced every year, and the fruiting shoot moves higher and higher thus getting out of reach (Yadav, 2007). Hence, proper pruning is instrumental in improving fruit quality by

maintaining a balance between vegetative and reproductive growth. Sufficient information is available on peach pruning in the world; however, the physiology of pruning in peaches/ nectarines is not well understood. Therefore, the present investigation was conducted to study pruning in relation to yield and fruit quality in nectarine.

MATERIAL AND METHODS

The study was conducted in the experimental orchard of Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.), during 2009 – 2011. Six-year old plants of nectarine cultivars 'Silver King' and 'Snow Queen', planted at a spacing of 2m x 3m were selected on the basis of uniform vigor. Experimental plants were subjected to variable pruning intensities in mid-December. Pruning method in peaches and nectarines involves two components, i.e., thinning-out (TO) by complete removal of intermingling shoots, and heading-back (HB) by cutting a portion of the bearing shoot. Different pruning intensities included: T_1- 20% TO + ¼ HB; T_2- 20% TO+ ½ HB; T_3- 20% TO + ¾ HB; T_4- 40% TO+ ¼ HB; T_5- 40% TO+ ½ HB; T_6- 60% TO+ ¼ HB; T_7- 60% TO + ½ HB; T_8- 60% TO + ¾ HB; T_9 (Control)- 40% TO + ¾ HB. Data on yield were recorded at optimum harvest time, and physical parameters like fruit-surface color, fruit weight and pulp:stone ratio were recorded. Total soluble solids were determined by Erma Hand Refractometer. Total sugar content and acidity of the fruit was estimated as per the standard method (AOAC, 1980). Fruits were graded into three categories, viz., three layer (55cm and above), four layer (46-55 cm) and loose (below 46cm), as described by Kumar *et al* (2013).

Data obtained from the investigation were statistically analyzed in the experimental set-up of Randomized Block Design, and differences exhibited in various treatments were tested for their significance as per Gomez and Gomez (1984).

RESULTS AND DISSCISSION

Perusal of the data presented in Table 1 reveals that fruit yield was affected significantly by pruning intensity. Highest fruit yield was recorded in treatment T_1 (20% TO + ¼ HB) which was least pruned. These results are in agreement with Robinson *et al* (2006) who observed highest yield in the least pruned peach trees. Reduction in fruit yield due to severe pruning could be attributed to a low number of floral buds available in such a treatment. Therefore, fruiting area got reduced. It is evident from data depicted in

Table 1. Effect of pruning severity on fruit yield in nectarine cultivars

Treatment	Fruit yield (kg/plant)		
	'Silver King'	'Snow Queen'	Mean
T_1 (20% TO* + ¼ HB**)	13.3	12.3	12.8
T_2 (20% TO + ½ HB)	11.9	10.7	11.3
T_3 (20% TO + ¾ HB)	10.5	9.4	9.9
T_4 (40% TO + ¼ HB)	12.1	11.3	11.7
T_5 (40% TO + ½ HB)	10.5	9.3	9.9
T_6 (60% TO + ¼ HB)	7.5	6.2	6.9
T_7 (60% TO + ½ HB)	9.8	8.7	9.2
T_8 (60% TO + ¾ HB)	11.5	10.1	10.8
T_9 (Control) ***	8.3	8.3	8.3
Mean	10.6	9.6	

*TO: Thinning Out; Treatment : 1.6
**HB: Heading Back; Cultivar : 0.7
***T9 (Control): 40% TO + ¾ HB Treatment × Cultivar : NS
CD *(0.05)*

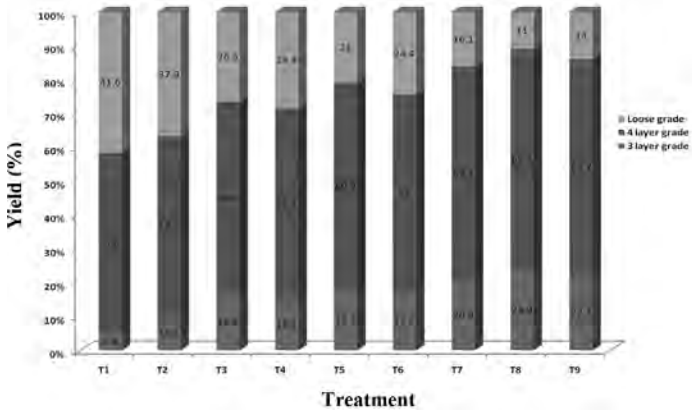

Fig 1. Effect of pruning intensity on yield of different grade fruits in 'Silver King' nectarine

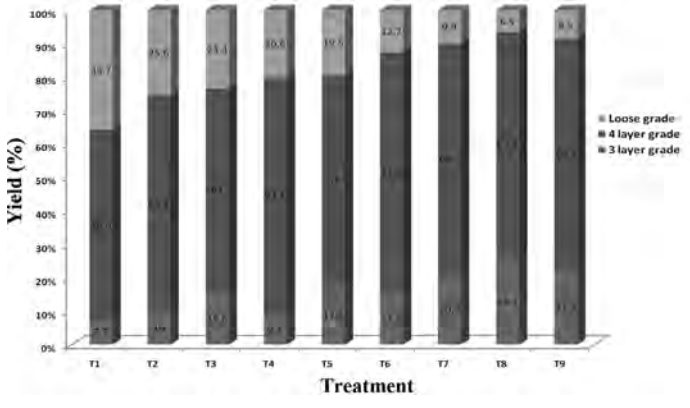

Fig 2. Effect of pruning intensity on yield of different grade fruits in 'Snow Queen' nectarine

Figures 1 and 2 that variable pruning intensity considerably influenced per cent yield of different fruit grades, viz., three layer, four layer and loose grade fruits. Production of three-layer and four-layer grade fruits was highest in the most heavily pruned trees, with 60 % TO + ¾ HB treatment;

Table 2. Effect of pruning severity on fruit-surface color, fruit weight and pulp:stone ratio in nectarine cultivars

Treatment	Fruit-surface color (%)			Fruit weight (g)			Pulp:stone ratio		
	'Silver King'	'Snow Queen'	Mean	'Silver King'	'Snow Queen'	Mean	'Silver King'	'Snow Queen'	Mean
T_1 (20% TO* + ¼ HB**)	62.1	54.5	58.3	30.4	29.8	30.1	6.2	5.5	5.8
T_2 (20% TO + ½ HB)	69.0	58.7	63.8	37.8	34.3	36.1	7.1	5.8	6.4
T_3 (20% TO + ¾ HB)	72.0	62.0	67.0	45.6	37.4	41.5	7.4	6.2	6.8
T_4 (40% TO + ¼ HB)	64.1	58.3	61.2	42.6	41.7	42.1	8.2	6.8	7.5
T_5 (40% TO + ½ HB)	78.5	63.2	70.8	49.4	45.1	47.3	8.8	6.5	7.6
T_6 (60% TO + ¼ HB)	72.3	63.3	67.8	55.4	48.6	52.0	8.6	7.6	8.1
T_7 (60% TO + ½ HB)	78.4	68.5	73.5	62.5	55.6	59.0	9.1	7.9	8.5
T_8 (60% TO + ¾ HB)	83.7	70.1	76.9	75.1	70.6	72.8	10.6	8.2	9.4
T_9 (Control) ***	82.3	75.4	78.8	73.1	68.4	70.8	9.5	9.2	9.3
Mean	73.6	63.8		52.4	47.9		8.4	7.1	

*TO: Thinning Out; **HB: Heading Back; ***T9 (Control): 40% TO + ¾ HB

CD *(0.05)*

Treatment	:	4.5	5.7	0.8
Cultivar	:	2.1	2.7	0.4
Treatment × Cultivar	:	NS	NS	NS

Table 3. Effect of pruning severity on total soluble solids and titratable acidity in nectarine cultivars

Treatment	Total Soluble Solids (%)			Titratable Acidity (%)		
	'Silver King'	'Snow Queen'	Mean	'Silver King'	'Snow Queen'	Mean
T_1 (20% TO* + ¼ HB**)	11.8	12.0	11.9	0.72	0.78	0.75
T_2 (20% TO + ½ HB)	12.3	12.4	12.4	0.69	0.75	0.72
T_3 (20% TO + ¾ HB)	13.1	13.1	13.1	0.66	0.71	0.69
T_4 (40% TO + ¼ HB)	12.2	13.0	12.6	0.65	0.69	0.67
T_5 (40% TO + ½ HB)	12.8	13.2	13.0	0.62	0.63	0.62
T_6 (60% TO + ¼ HB)	13.3	12.6	12.9	0.59	0.61	0.60
T_7 (60% TO + ½ HB)	13.8	13.4	13.6	0.56	0.58	0.57
T_8 (60% TO + ¾ HB)	14.2	13.7	13.9	0.51	0.55	0.53
T_9 (Control) ***	14.2	14.1	14.1	0.53	0.53	0.53
Mean	13.1	13.1		0.61	0.65	

*TO: Thinning Out; **HB: Heading Back; ***T9 (Control): 40% TO + ¾ HB

CD *(0.05)*

Treatment	:	0.7	0.05
Cultivar	:	NS	0.02
Treatment × Cultivar	:	NS	NS

whereas, trees with lighter pruning intensity, i.e., T_1 (20% TO + ¼ HB) produced higher proportion of loose grade fruits. 'Silver King' produced more number of three-layers and loose-grade fruits, while, production of four-layer grade fruits was higher in 'Snow Queen'. A reduced number of flower buds on severely pruned trees were amply compensated by increased fruit size. Hence, fewer and heavier fruits were produced with heavy pruning.

Fruit quality parameters of both the nectarine cultivars namely, 'Silver King' and 'Snow Queen' as affected by different pruning severities are presented in Tables 2 and 3. Data presented in Table 2 reveal that pruning had significant influence on fruit quality. Highest fruit-weight and pulp:stone ratio was observed in the treatment T_8 (60% TO + ¾ HB), where pruning severity was the highest. However, better fruit-surface color was recorded with 40% TO + ¾ HB. Fruit-surface color, fruit-weight and pulp:stone ratio in 'Silver King' was better than that in 'Snow Queen'.

Fruit-surface color improved with increasing pruning severity due to increased penetration of direct sunlight in to the canopy and fruits. Pruning reduced number of flower-buds and, consequently, the number of fruits; as a result, fruit weight usually increased. Similar results of increase in the fruit weight with increasing pruning severity have been reported by Hassani and Rezaee (2007). Increased pulp:stone ratio in the present investigation is supported by the work of Mahajan and Dhillon (2002) who recorded maximum pulp weight with 75% heading-back compared to that with 50% and 25%, while, stone weight remained unaltered in 'Shan-i-Punjab' peach.

Total soluble solids and titratable acidity were also significantly affected by different pruning treatments (Table 3). Highest total soluble solids were recorded in T_9 (Control, 40%TO + ¾ HB). Highest titratable acidity was recorded in T_1 (20%TO + ¼ HB) where the intensity of pruning was lower. Higher amounts of total soluble solids in the fruit with increasing pruning severity may be associated with an increase in leaf:fruit ratio resulting in augmented availability of photosynthates, and uptake of nutrients from soil. More severe pruning resulted in significant reduction in fruit acidity, probably attributable to increased fruit-size and moisture content. These findings are in agreement with Rathi *et al* (2003) and Sharma and Chauhan (2004) who too reported increased TSS with increasing pruning intensity in 'July Elberta' peach.

From this study, it is concluded that the best results in terms of fruit weight and pulp:stone ratio in nectarine were obtained with 60% thinning-out and ¾ heading-back; but, fruit yield was lower with this treatment. However, best grade fruits, i.e., 3-layer fruits were obtained at this level of pruning in both the cultivars under study.

REFERENCES

A.O.A.C. 1980. Official methods of analysis. Association of Official Analytical Chemists, 13th edition, W. Horowitz (ed.), Benjamin Franklin Station, Washington DC p. 101

Anonymous. 2013. Area and production of fruit in Himachal Pradesh (unpublished report). Department of Horticulture, Shimla, Navbahar (HP)

Badiyala, S.D. and Awasthi, R.P. 1989. Effect of pruning severity on yield and quality of peach cv. Elberta. *Haryana J. Hortl. Sci.,* **18**:204-209

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedure for agricultural research (2nd ed.), John Wiley, New York, p. 680

Hassani, G. and Rezaee, R. 2007. Effect of training system and rate of pruning on yield and quality of peach fruit. *Agri. Sci. Tabriz,* **17**:31-38

Kaur, Harminder. 2010. Pruning of deciduous fruit trees. *Hort. Newslett.,* **6**:1-2

Kumar, K., Thakur, K., and Singh, D. 2013. Peach. In: Fruit Production in India. W.S. Dhillon (Ed.), Narendra Publishing House, Delhi, pp. 457-478

Mahajan, B.V.C. and Dhillon, B.S. 2002. Effect of pruning intensities on the fruit size, yield and quality of peach cv. Shan-i-Punjab. *Agril. Sci. Digest,* **22**:281-282

Mika, A. 1986. Physiological responses of fruit trees to pruning. *Hort. Rev.,* **8**:337-367

Rathi, D.S., Dimri, D.C., Nautiyal, M.C. and Kumar, A. 2003. Pruning responses to shoot growth, fruit set and yield in peach. *Indian J. Hort.,* **60**:151-153

Robinson, T.L., Andersen, R.L. and Hoying, S.A. 2006. Performance of six high-density peach training systems in the Northeastern United States. *Acta Hort.,* **713**:311-320

Rom, C. Roy. 1988. The Peach: Its History and Future. In: The Peach: World cultivars to marketing. Norman F Childers and Wayne B Sherman (eds.), Dr. Norman F. Childers Publications, Gainesville, Florida, pp. 1-6

Sharma, D.P. and Chauhan, J.S. 2004. Response of pruning intensities and fertilizer treatment on yield, fruit quality and photosynthetic efficiency of peach. *Acta Hort.*, **662**:237-241

Yadav, P.K. 2007. Fruit Production Technology. International Book Distributing Company, Lucknow, U.P., p. 372

(MS Received 02 August 2013, Revised 22 January 2014, Accepted 15 February 2014)